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told briefly and clearly, and their separation from gymnosperms as a coordinate group is defended, the provisional diagnosis being as follows: "Male and female sporophylls little differentiated from the vegetative foliage; no cones formed. Anatomy of either stem, or leaf, or both, of a Filicinean type, as was also the habit." It is hard to see that such characters are more important than those which distinguish the acknowledged groups of gymnosperms, and of equal importance with those that distinguish gymnosperms from angiosperms. The relations of the pteridosperms to the Cycadophyta and to the Cordaitales are also discussed. The whole paper is an admirable résumé of our knowledge of the subject, and will serve to present it clearly to many botanists who have either no time to consult the numerous original papers or no access to them.

BIBLIOGRAPHY OF PALEOZOIC FOSSIL PLANTS.—The third paper is an exceedingly useful bibliography prepared by ARBER.⁴ There is first a list of general monographs and textbooks, followed by a list of memoirs on special subjects, after which the titles are arranged stratigraphically, beginning with the Silurian. Under each geological period, beginning with the Devonian, the arrangement is by plant groups and by countries.

GEOGRAPHIC BOTANY.—The fourth paper is by FLAHAULT.⁵ After a general historical and explanatory introduction, the subject is presented under the following captions: (1) Descriptive phytogeography (Floristics), (2) Physiological phytogeography (Ecology), (3) Ontogenetic phytogeography, and (4) Historical phytogeography. The second topic occupies the largest space, the principal subtopics being discussions of the ecological factors, temperature, water, light, soil, humus, and the various so-called climates. Ontogenetic phytogeography deals with the history of the distribution of plants, including the historical origin of groups, migrations, and the succession of floras. Under historical phytogeography the work of man in relation to floras is discussed, including such subjects as the sources of rivers, mountain forests, dunes, etc. The paper brings together in an organized form the study of vegetation from the various points of view that have been often lumped under the general and very indefinite title Ecology.—J. M. C.

A South African textbook in botany

This is not the first elementary textbook written for use in the South African schools, but it is perhaps the first to give so much attention to the ecological point of view.⁶ In this respect it is to be compared with the elementary text-

⁴ ARBER, E. A., NEWELL, Bibliography of literature on palaeozoic fossil plants, including some of the more important memoirs published between 1870-1905. Op. cit. 1:218-242.

⁵ FLAHAULT, CH., Les progrès de la géographie botanique depuis 1884, son état actuel, ses problèmes. Op. cit. 1:243-317.

⁶ STONEMAN, BERTHA, Plants and their ways in South Africa. 8vo. pp. ix+283. London: Longmans, Green, & Co. 1906. \$1.10.

books of COULTER or BERGEN. It is refreshing to miss the old familiar cuts that have done service for so long. Not only do the photographic reproductions represent South African scenes, but even the diagrams and cuts are made from South African plants, and for the most part especially for this book. The first chapters deal with seeds and germination, growth and duration of the vegetative organs, and various fundamental physiological topics. The chapter on plant defenses is illustrated by some of the remarkable desert xerophytes of the region, such as *Crassula* and *Mesembryanthemum*. Then follow chapters on vegetative reproduction, climbing plants, and migration. After a rather full consideration of flowers and fruits, there is a simple but useful key to the more conspicuous plants of the region. The old-fashioned order of BENTHAM and HOOKER is used in the classification, but this is probably justified by the fact that South African systematic works have followed the BENTHAM and HOOKER scheme. The book should do its part in making botany in the schools a more living and attractive subject.—HENRY C. COWLES.

MINOR NOTICES

Spontaneous heating.—The “heating” of hay and compost heaps has been an interesting biological phenomenon as to whose causes many were content to reason, but few to experiment. MIEHE recently published a scientific summary of his work, which is now followed by a booklet, addressed to a wider audience.⁷ It embodies his own investigations for the past two years, to which are added the facts already known, so as to make a complete discussion of this subject, which is of both biological and practical interest.

The topics treated are: The course and maximum of the rise of temperature; chemical changes in the heating of compacted hay with exclusion of oxygen; cause of heating; culture substrata and researches with pure cultures; description of the nine most important organisms found in hay; self-sterilization by heating; the conditions of existence of thermophilous organisms in nature; heating plant materials as brood-beds for pathogenic organisms; relation of the fermentation of tobacco to the heating of hay; respiration and warmth; heating and spontaneous combustion, present and past.

The book will be particularly useful to men in experiment stations who are concerned with this problem, as it forms an excellent summary of present knowledge. It is handicapped by lacking an index, though it has an exhaustive bibliography.—C. R. B.

The origin of species and varieties by mutation.—It is an encouraging sign when such a scientific treatise as Professor DEVRIES' *Species and varieties* comes to a second edition within one year.⁸ Probably no work on evolution written in

⁷ MIEHE, HUGO, Die Selbsterhitzung des Heus. 8vo. vi+127. figs. 11. Jena: G. Fischer. M3.50.

⁸ DEVRIES, HUGO, *Species and varieties; their origin by mutation*. Edited by D. T. MACDOUGAL. Second edition. 8vo., pp. xviii+847. Chicago: The Open Court Publishing Co. 1906.